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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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INVENTOR(S)		
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TITLE OF THE INVENTION (500 characters max)

HOCKEY SAFETY DEVICE

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ENCLOSED APPLICATION PARTS *(check all that apply)*

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[ ] Application Data Sheet. See 37 CFR 1.76
[ ] CD(s), Number _____
[x] Other (specify) PTO FORM 1595 and Assignment

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

[✓] Applicant claims small entity status. See 37 CFR 1.27.
[✓] A check or money order is enclosed to cover the filing fees.
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FILING FEE Amount ($): 120.00 for filing fee and recordation fee

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[✓] No.
[ ] Yes, the name of the U.S. Government agency and the Government contract number are: _____

[Page 1 of 2]

Respectfully submitted,

SIGNATURE _____

Date 2/5/04

REGISTRATION NO. *(if appropriate)* 26,868

Docket Number: 14608PRO

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HOCKEY SAFETY DEVICE

Field of Invention

The present invention relates to a safety device for the sport of hockey, specifically a device mounted to a hockey helmet to sense when a player's head is facing downward and provide an audible indication or other alarm signal to alert a player.

Background of the Invention

Ice hockey is a game played on an oval rink with a framed perimeter of wood typically called boards. Young and inexperienced hockey players often stick handle and retrieve pucks from the boards with their heads down.

Many serious injuries suffered by young hockey players today are the result of body checks. These injuries are often sustained because the players tend to keep their heads down and are unaware or unprepared for impending collisions. Many serious head and neck injuries occur when a player is retrieving a puck near the boards or skating down the ice with their head down and receives a body check by an opposing player.

The common mistake of keeping one's head down when first starting to play often becomes a permanent habit which is very difficult to overcome once entrenched from an early age. This ongoing practice could result in some form of bodily injury and/or severe limitation in the player's career.

There have been prior devices which attempt to monitor head position in various different sports. Most prior art refers to profiling the head position and motion as they relate to optimum, predefined values which are

primarily used as a teaching aid or tool. Sports such as golf, baseball, tennis etc. have been approached this way. Prior art devices generally involve complicated components such as accelerometers and gyroscopes to establish a real time data base of angular position and velocity. This data is then compared with pre-stored optimum values as they relate to the various sports activities for analysis. Sometimes an audible alarm is activated when the real time motion does not follow an idealized motion.

Existing devices tend to be overly complicated, large, bulky, and expensive. They often require another individual to operate the equipment which renders it ineffective for helmet-mounting on individual players. The objects of most existing art that are electronic-based, claim to profile a player's head position and motion for teaching and instructional purposes. For singular applications which do not require this level of sophistication such as accelerometers, gyroscopes or other similar devices to track and collect real time data, only to alarm when a player has his/her head down, the existing art becomes too expensive, bulky and unsuitable.

Most prior art and existing patents focus primarily on profiling the head position and other body parts as they compare to optimum predefined values for the purposes of training. Only one patent was found to contain any reference to a helmet-mounted device which could be used to warn the user of a dangerous head position. In particular, the patents of Socci, et al # 6,048,324, #5,447,305, #5,428,846, #5,380,001.

U.S. Pat. No 5,380,001 by Socci, et al. describes a baseball batting aid using an adjustable sensing mechanism fitted on to a batter's helmet to sense the vertical movement of the batter's head with an audible alarm and power supply. The purpose is stated to be a training device which can be worn by a user to teach the correct body positioning when hitting a baseball with the main sensing

element being a mercury tilt switch. This system would not work as a hockey safety device primarily because of the extreme sensitivity of the mercury tilt switch. In a normal horizontal position, the switch will activate with the slightest head movement thereby causing numerous false alarms. In a hockey application, the head position is constantly moving in all directions. To reduce the sensitivity would require adding additional mechanisms which the user can adjust to change the tilt position of the mercury switch. This adds bulk, weight and sensitive mechanical components that could break down given the extreme physical nature of hockey. Furthermore, the mercury which is enclosed in a glass tube, is considered one of the most dangerous elements to humans. The Socci device is made up several separate and bulky elements that are required to be mounted onto a helmet with a top pad plug through the helmet for user access. This is fine for a controlled teaching situation where there are limited movements with virtually no physical bodily contact, however in a competitive hockey environment the device must be extremely small, lightweight, securely-mounted and impact-resistant. Hockey helmets are certified safety devices that have to withstand extreme impact while protecting the wearer thus user access plugs through the helmet would not be allowed.

U.S. Pat. No 5,428,846 by Socci, et al. describes a device for aiding the teaching and training techniques for hitting a baseball accommodating different initial head positions and batting styles. Comprised of a helmet fitted with a mercury switch connected to a motor, 2 magnetic switches are located on each side of the helmet and a magnet is located on the batter's shirt pocket. Related power supplies, alarms and circuitry are provided. This is even less suitable to a hockey situation than the device described in Pat. No 5,380,001 by adding, motors, linking mechanisms and magnets located on different body parts

U.S. Pat. No 5,447,305 by Socci, et al. describes a training device which can be worn by the user to teach the correct body position when hitting a

baseball and is comprised of either 3 gyroscopes or accelerometers to measure the angular motion of the head with related electronic circuitry, alarms and power sources. The output of these gyroscopes or accelerometers would be compared to fixed values set by the user via adjustable potentiometers which establish acceptable ranges of motion.

Socci's focus in the progression of patents from devices with a simple mercury switch to accelerometers and gyroscopes, is to improve the teaching and training aspect of the devices in a controlled, non-physical environment. Adding very expensive components such as accelerometers and gyroscopes would make the device extremely expensive and unusable for the high volume hockey player market to say nothing of the added size, weight and impact issues.

U.S. Pat. No 6,048,324 by Socci, et al describes a head gear to sense the motion of the wear's head motion about 2 mutually perpendicular axes. Again accelerometers and gyroscopes with related analog to digital converters and microprocessor are used to execute the control logic and store user-supplied data of known motions as they relate to the various sports.

The progression of the Socci development is towards more elaborate and sophisticated devices requiring a user to know how to program and download firmware. These advanced features are good tools for a teaching or training aid product but totally unnecessary and impractical for the demanding physical world of real time hockey.

For this singular sports application, the helmet-mounted, present invention is extremely small, lightweight and only outputs an audible alarm if the player's head is in a downward position. This audible alarm reminds the player to

raise his/her head to avoid bodily injury by an opposing player or to be aware of other surrounding players and position.

Objects of the Invention

An object of the invention is to overcome the many drawbacks of existing complicated products that are designed as teaching tools.

Another object of the invention is to provide a safety device that is battery operated, miniaturized, lightweight, easily mountable and highly energy efficient.

Another object of the invention is to provide a safety device which is inexpensive and capable of high volume manufacture.

Another object of the invention is to provide a safety device that provides to a player indication when his/her head is in a downward position while participating in sports.

Another object of the invention is to provide a safety device that detects head position in the vertical axis.

Another object of the invention is to provide a safety device that alerts a hockey player of a potentially dangerous head position.

Brief Description of the Drawings

The apparatus of the invention will now be described with reference to the accompanying drawings, in which:

Fig.1 is a block diagram of the embodiment of the present invention;

Fig.2 is a perspective view of one embodiment of the invention;

Fig.3 is a schematic of the circuit for an embodiment of the invention;

Fig.4 depicts an embodiment of the invention mounted within a protective hockey helmet;

Detailed Description of the Invention

In order to more clearly understand the present invention part numbers as assigned in the following parts list will be used:

Part Number	Description
5	Power Source
10	Processor
15	Sensor
20	Indicator
25	Activation Means

The apparatus and method for using an electronic device attached to a hockey helmet to achieve the objects of the invention may include the five main functional blocks: battery source, processor, sensor, activation means and indicator.

Power Source

The power source 5 for the device is typically a 3V Lithium coin cell battery or other low voltage miniature battery source. These batteries are small, lightweight and readily available.

More specifically, the power source preferred is a standard long life lithium coin cell battery, typically with a capacity of >200 mah. Future power

sources that could enhance the product would be a rechargeable lithium battery which could be recharged via a photo-activated device while the helmet is being used in a normal game under lights. This would significantly extend the life of the battery to possibly several years.

Processor

Processor 10 is preferably a microcontroller chip such as the Atmel Tiny12V. This type of processor typically operates between 1.8 to 5V DC, 1K Byte of flash program memory and 64 Bytes of EEPROM memory. Typically the microcontroller would be factory programmed with the system operating logic.

The control algorithm residing in the firmware is designed to accommodate nuances in a real world hockey application. When the battery is first inserted into the device the microcontroller wakes up and checks the activate photo sensor to see if ambient arena light is present. If no light is present it goes in power down mode (sleep mode) and remains there until it is activated by arena light, thus conserving power and extending the battery life. The assumption here is that the helmet is in the equipment bag or on its side not being used. Once light has been detected for the first time, the microcontroller then begins to scan the photo interrupter (tilt switch) to determine if it is on or off. There is a 500msec delay before the alarm is initiated. This is to prevent unwanted alarms when a player momentarily puts their head down. The player must have their head down for >500 msec before the alarm sounds. The alarm will continue as long as the player has their head down and will shut off or return to normal when the head is raised. In some situations where a player might be down on the ice for several seconds or minutes, the alarm will only continue for 1 minute then stop. When the player gets up and resumes play, the microcontroller will return to scanning the photo interrupter. During a face off, the player should not have their head down to the point where the device goes into alarm. This will train the player to keep the

head position up during a face off. During a normal game the head position may be such that the ambient arena light is no longer impinging on the photo sensor. In these cases, the microcontroller will wait 5 minutes before going into power down mode (sleep mode). The device will wake up and resume normal operation once it detects ambient arena light. In the case where the player is on the bench and not playing, the microcontroller will keep track of the time between alarm activations. If this time is > 5 minutes then the microcontroller will go into idle mode which also conserves power. It will resume normal operation when the next alarm is initiated. Once installed the device functions transparently to the user and will only require servicing when the battery needs to be changed. An additional function of the microcontroller is to constantly monitor the battery voltage and to sound an audible alarm when it becomes too low.

Sensor

Sensor 15 is preferably a photointerrupter for detecting tilt in the vertical plane.

The sensor device is the component which senses head position only and activates by means of a voltage level change from a normal upright head position to a downward-looking head position of >-75 degrees. There are currently many devices in the marketplace today which can accomplish this function such as a simple mercury switch, however given the nature of the game and the constant motion of the body and the head, such a device would be unsuitable because of high number of false activations. An ideal device would only activate when the head position was deliberately held in the down position for greater than 1 sec.

A preferred device would be a photo interrupter tilt sensor which is made up of small steel ball, a photo source (led) and photo detector in a small enclosed plastic housing. In its normal position the photo sensor is able to detect

light generated by the led. As the head moves in the downward direction, this causes the ball to also move which then blocks the beam of light resulting in a voltage level change on the photo detector. When the head is returned to its normal position the small ball moves back to its resting position allowing the photo detector to once again detect the light generated by the led thus reversing the voltage level change. Suitable alternate devices could be based on a piezo element or Hall Effect switch in conjunction with a moving object such as steel ball.

Activation Means

Activation means 25 is typically an enabling device to activate the microcontroller and arm the system. The auto on/off switch fall under the heading of activation means. The main purpose of this on/off switch in its basic mechanical form is to simply toggle the power source on or off the device by engaging or disengaging the power source. This of course requires the player to manually activate the device. Other more sophisticated devices which accomplish the same objective (to activate the device) could be a photo switch which would activate the device when there is arena light present, or a motion sensor (PID sensor) which would activate the device when it senses player motion. The output of these devices would be a digital signal which would wake up the microcontroller 10 to initiate monitoring of the photo interrupter (tilt switch). Given the preferred mounting location of the device (on the top of the helmet in between the inside of the helmet and the foam padding) the latter two devices are ideal since they require no manual activation and are thus fully automatic and transparent. Both these devices would require a small hole on top of the helmet to facilitate ambient light sensing. As stated earlier the main function of the activate device is to wake up the microcontroller so that it can begin to monitor the photo interrupter. As long as this photo activated device continues to see ambient light the microcontroller will continue to operate normally, i.e. alarm only when the head position is down for >1 sec. When ambient light is not detected for >5 minutes, the microcontroller

will then go into power down mode which stops all monitoring and conserves power. Thus the player does not have to remember to manually activate or deactivate the device. This conserves power and extends the battery life but more importantly the hockey safety device will always be ready to function.

Indicator

In these embodiments, indicator 20 is typically an audible device which provides a sound alarm to the player such as a miniature ceramic speaker like a piezo transducer.

The indicator 20 could be a variety of different output alarms to alert the player. Typically it could an audible alarm such as a piezo beeper or pre-recorded message such as "heads up". The problem with an audible device is that given the loud ambient noise during a real game scenario in a hockey arena, the player may have difficulty hearing the alarm. If the intensity of the alarm is increased it may annoy or cause discomfort, and in the worst case, be removed.

Other suitable devices might be a vibrating alarm which would gently vibrate when the head is in a dangerous downward position. The disadvantage of this is that it adds cost, bulk, weight and draws considerably more power which decreases the battery life. Visual indicators such as leds are considerably less expensive, draw very little power and are extremely small but are difficult to position so that the wearer can see it without becoming a distraction. The concept behind the visual indicator however was not to provide the wearer with visual feedback of head position but for other approaching players to be cautious and lessen the impeding body check. Ideally the indicator may be a combination of a low intensity audible alarm for the player and a flashing led warning alarm on top of the helmet for opposing player. This would not only alert the player that their

head is in a dangerous position but would also warn the opposing player to be less aggressive and more cautious in applying a body check, thus resulting is significantly fewer injuries to both players.

Housing

As shown in figure 2 and 4, the safety device is preferably contained in a small, lightweight plastic case and typically mounted in a hockey helmet sandwiched between the upper padding and the top inside surface. Attachment of the device to the helmet is done by some mechanical means such as Velcro strips or adhesives.

The small lightweight case or housing which contains the circuit boards, electronic components and battery source will be made of impact resistant and fire retardant material such as a polycarbonate. The case could be made up of two sections -- a top side with a small centre hole which will allow ambient light to impinge on the photo activated device, and a bottom side which will snap together with the top side. Because of its small size and light weight, the safety device can be directly mounted to the underside of the helmet and simply attached by way of 2 small Velcro strips or other suitable mechanical means such as pop rivets or adhesives. With the top side firmly secured to the helmet the player can still pry open the bottom side of the case to replace an expired battery as required.

5

Fig.1

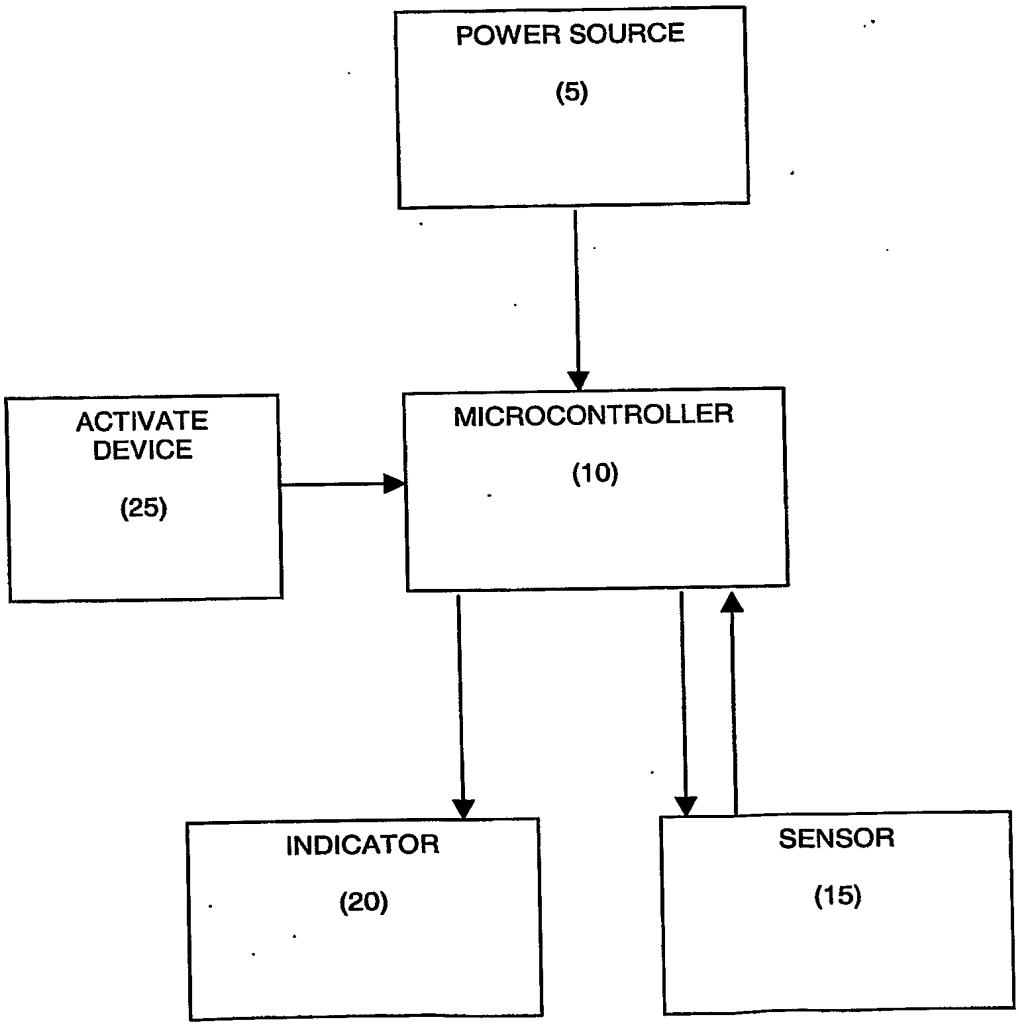

Fig.2

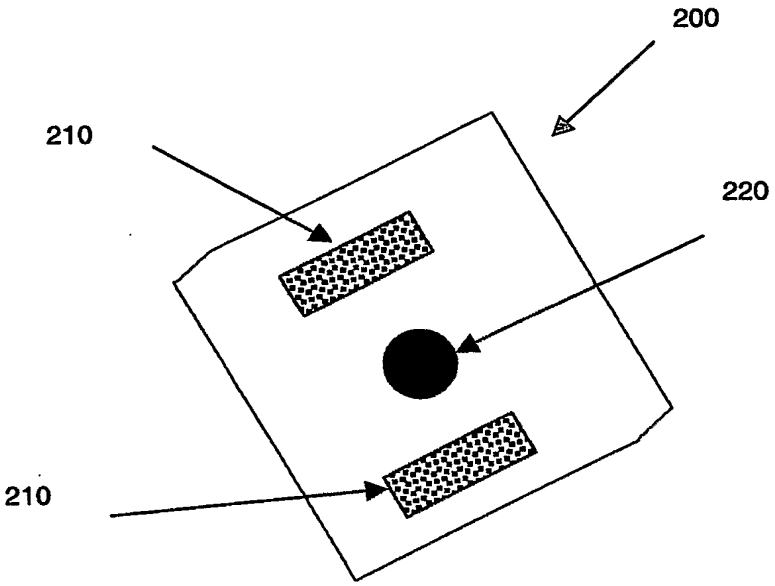

Fig.3

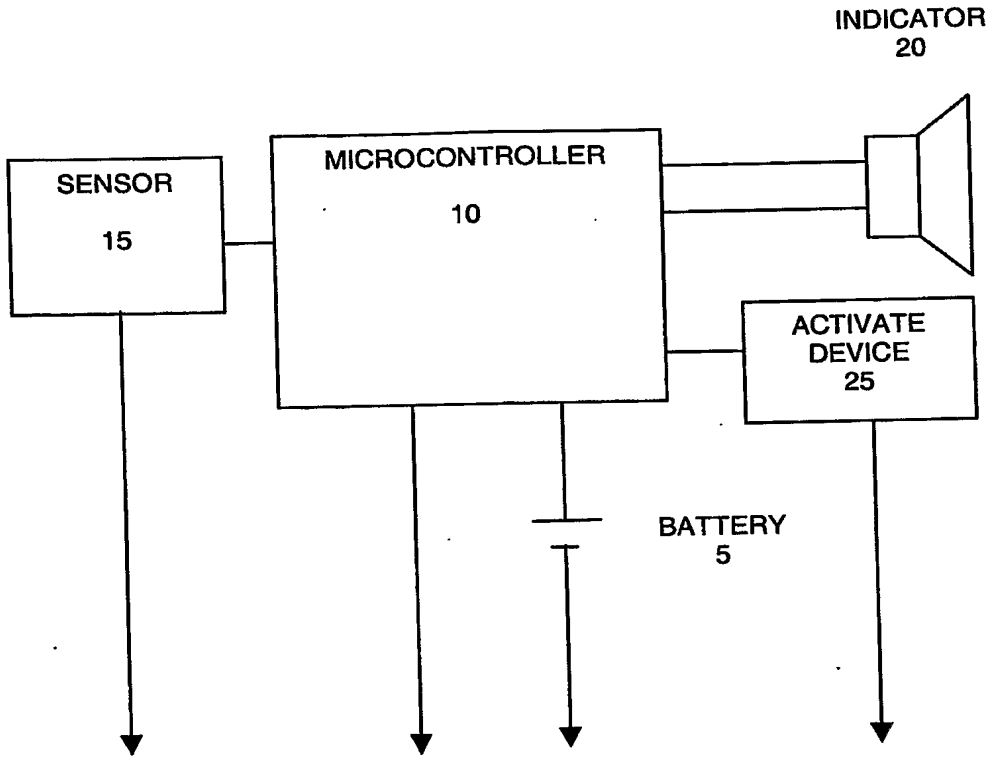

Fig.4